**Ch. 25: Paired t-Test**

* We are testing the…

**PAIRED DATA**

**MATCHED PAIRS t-TEST**

**EXAMPLE:** A random sample of 12 sixth graders was given a memory test. They were then enrolled in a 9-month chess program. At the end of the program they were given another memory test. The researchers were interested to see if learning chess would increase memory.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Student** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **Pretest** | 510 | 610 | 640 | 675 | 600 | 550 | 610 | 625 | 450 | 720 | 575 | 675 |
| **Posttest** | 850 | 790 | 850 | 775 | 700 | 775 | 700 | 850 | 690 | 775 | 540 | 680 |

**MATCHED PAIRS t-INTERVAL:**

Complete the interval for the same data set

**TRY THESE:**

1. A manufacturer wishes to compare the wearing qualities of two different types of automobile tires, A and B. For the comparison, a tire of type A and one of type B are randomly assigned and mounted on the rear wheels of each of five automobiles. The cars are then operated for a specified number of miles, and the amount of wear is recorded for each tire.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| A | 10.6 | 9.8 | 12.3 | 9.7 | 8.8 |
| B | 10.2 | 9.4 | 11.8 | 9.1 | 8.3 |

2. Do the data present sufficient evidence to indicate a difference in the average wear for the two tire types?
3. a) Test the hypotheses at the 0.07 significance level.
4. b) Estimate the mean difference in wear by constructing a confidence interval. Use your alpha to determine what level of confidence you should use.
5. In response to a complaint that a particular tax assessor (A) was biased, an experiment was conducted to compare the assessor named in the compliant with another tax assessor (B) from the same office. Eight properties (1 – 8) were selected, and each was assessed by both assessors. The assessments (in thousands of dollars) are shown in the table.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| A | 76.3 | 88.4 | 80.2 | 94.7 | 68.7 | 82.8 | 76.1 | 79.0 |
| B | 75.1 | 86.8 | 77.3 | 90.6 | 69.1 | 81.0 | 75.3 | 79.1 |

1. a) Do the data provide sufficient evidence to indicate that assessor A tends to give higher assessments than assessor B? Test using α = .05.
2. Estimate the difference in mean assessments for the two assessors.

**WORKSHEET: Inferences on means**

Read the following problems and do the following:

1. Write down all important information
2. Determine (and write the name of) the inference procedure you need to use
3. Write the hypotheses and the conditions
4. Write the test statistic (ONLY USE YOUR FORMULA SHEET!)
5. The distribution of scores of students taking the LSATs is claimed to have a mean of 521. We take a sample of 100 incoming Harvard Law School freshman LSAT scores and find a mean of 589 and a standard deviation of 37. Since Harvard is an Ivy League school, they think their freshmen are smarter than average law students. Test this theory (that Harvard students score higher than average on the LSATs) at the 0.05 significance level.
6. A teacher wants to test the effectiveness of a new textbook. She believes that this new textbook is easier to read, and that her students should have better grades on their tests this year than they have in the past. She took a random sample of test scores from last year’s classes, and then a random sample of test scores from this year’s classes. Assume normal populations for both years. Test her theory at α= 0.01.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Old book** | |  |  |  | **New book** | | |  |  |
| 85 | 84 | 91 | 75 | 65 | 94 | 62 | 86 | 89 | 80 |
| 75 | 82 | 84 | 89 | 62 | 96 | 88 | 88 | 79 | 75 |
| 74 | 64 | 58 | 95 | 50 | 94 | 84 | 86 | 78 | 64 |

1. A football coach is frustrated with his team’s lack of speed. He measures each player’s 40-yard dash speed and then sends all of them to a speed and agility camp. He then measures their times again after. The data is below. Is their sufficient evidence to say that the camp helped the players speed? Run a test.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Before** | 4.88 | 5.1 | 4.41 | 4.73 | 4.6 | 4.8 | 4.95 | 4.98 | 5.2 | 5.13 | 5.05 | 4.9 | 4.7 | 4.6 | 5.11 |
| **After** | 4.7 | 4.85 | 4.35 | 4.77 | 4.56 | 4.78 | 4.7 | 4.9 | 5 | 5.1 | 5.1 | 4.7 | 4.56 | 4.34 | 4.9 |

1. Poisoning by DDT causes tremors and convulsions and slows recovery times of muscles. In a study of DDT poisoning, researchers fed several lab rats a measured amount of DDT. They then made measurements of the rats’ refractory period (the time needed for a nerve to recover after a stimulus). In their sample they find the following times: 1.61, 1.9, 1.53, 1.4, 1.33, 1.81, 1.3, 1.25, 1.65. Estimate the average refractory period using 95% confidence. If we know that the mean time for unpoisoned rats is 1.3 milliseconds, does your interval give evidence that the time has changed?
2. The Chapin Social Insight Test is a psychological test designed to measure how accurately a person appraises other people. The possible scores on the test range from 0 to 41. During the development of the test, it was given to several groups of people. Here are the results for male and female college students at a liberal arts college:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **n** | **avg.** | **std.dev** |
| **Male** | 133 | 25.34 | 5.05 |
| **Female** | 162 | 24.94 | 5.10 |

Does the data support the contention that female and male students differ in average social insight? Use 96% confidence to make your conclusion.